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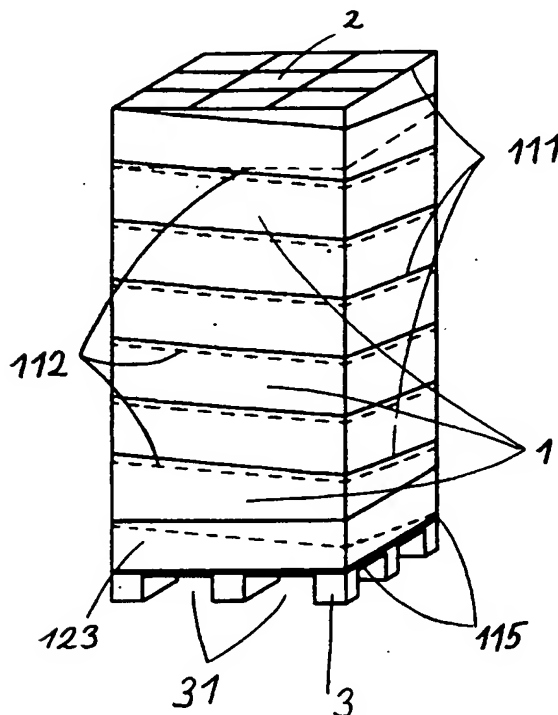
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(54) **Palletized loads wrapped with stretchable film, process and apparatus for making them.**

(57) Disclosed are palletized loads (2) formed by a plurality of packages (21) and wrapped in stretchable film (1) as well as a related process and apparatus to produce such palletized loads (2). The stretchable film (1) has strengthened sections (111, 112, 113, 211, 212) generated by folded or rolled edges (11, 12) or folded central parts and, where said film (1) connects the load (2) to the pallet (3), it has a roped lower edge (115).

Figure 5



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This invention relates to loads, formed by a plurality of units, wrapped in stretchable film and anchored to a pallet, the process and apparatus to produce such packages.

More particularly the invention relates to stretchable film with folded or rolled edges, which is spiraling around a load, combined with fixing the load to a pallet by roping the lower edge of the film where it circles
 5 around the pallet thus increasing the stability of the entire package while reducing material consumption, duration of wrapping operation and improve at the same time handling of the palletized load.

Background Art

10 There are many different packaging materials available for loads consisting of a plurality of units standing on a pallet. A widely used type of packaging material is a stretchable film wrapped around the load and the pallet. Loads wrapped in stretchable film, as well as processes to achieve this and a variety of machines capable to carry out such processes are well known in the art, however stability problems of the complete package have so far often been resolved by employing extra material such as cardboard corner
 15 packaging aids and extra layers of stretch film itself.

The principle of stretch wrapping is that a stretchable film is guided from an unwind and stretching location around a load by relative rotation between a load and the film supply in a spiral configuration. In one execution the load is mounted on a table, which turns around a vertical axis and is thereby winding the film around the load. At the same time the film supply moves along a vertical path such that a wrapper
 20 spiraling around the load is produced. The vertical path of the film usually starts at one end of the load, top or bottom, moves to the other end of the load and returns to the starting point to allow the next load to be wrapped in the same manner. Together the rotation and the vertical path up and down create double layers of film with opposite spiraling direction. However more than two layers or wide overlaps are often needed, especially to attach the load to a pallet, in order to ensure sufficient stability of the package. Good examples
 25 of such packaging, processes and apparatuses are contained e.g. in US-patent 3,863,425, UK-patent GB 2,063,809, German patent DE-2 724 100 or European patents EP-A 306 573 and EP-A 22 135.

Another process of application is to have a stationary load and rotate the entire unwinding and stretching equipment around the load. This alternative application is frequently called satellite application and is especially useful if rotating the load causes problems or is impossible. Descriptions of this and
 30 similar alternatives are disclosed in DE 3 414 964, US-appl. 411,995 or EP-A 279 871 and are widely used by the industry.

Further improvements in the technical field that have been disclosed are all based on these two basic stretch wrap applications. However they all suffer from the drawback of high film consumption and frequently require packaging aids to provide the necessary stability.

35 Developments towards more economic usage of the film are described in US-4,497,159 and GB-2 083 002 by increasing the elongation of the film and thus reducing the amount of film per package.

Similarly developments were made allowing to use various kinds of stretch film material. US patent US-4,432,185 describes bunching the front and rear end of a non-self-adhesive stretch film into a rope to facilitate fixation of the rear end to the front end of the film. EP-A 32 140 describes an improvement to the
 40 fixation of the front end of the stretch film by controlled wrapping over the front end of the film with successive layers of stretch wrap.

In US 4,807,427 roping of stretch film material is described to engage with a baseload container thus fixing a top and bottom cover to the stretch wrapped load.

For loads formed by goods stacked in layers over each other US-patent 4,845,920 describes roping of
 45 the edges of stretch film and applying it in horizontal bandages such that one bandage joins two layers together. This is done to utilize the ease of application of stretch film but allow breathability of the load since the bandages are spaced vertically apart. Similar layer combining bandages are disclosed in EP- 177 413 without roping of the edges of the stretch film.

Finally EP-A 298 799 discloses equipment for stretching adhesive film to such an extent that the rupture
 50 resistance of the edges requires enhancement by wrinkling some of the film edge together. Furthermore it describes controlling the amount of film wrinkled at the edges to create narrow film sections allowing breathability of the load.

A drawback common in stretch film applications is that in order to ensure stability a high degree of vertical overlap of the spiralling stretch film layers is used. In addition, to securely attach the load to a
 55 pallet, many layers of stretch film are wrapped horizontally around the pallet and part of the lowest layer of units. Despite this effort sufficient stability was often not achieved resulting in consumer and customer dissatisfaction with disorderly loads on a pallet at inflated stretch film consumption. In addition, the film attaching the load to the pallet also covers the holes in the pallet designated for forklifts to handle pallets.

These parts of the stretch film are often punched by forklifts further reducing stability, creating another esthetical disadvantage and often being unacceptable for automated warehousing.

It is therefore an objective of the present invention to supply a load wrapped in stretch film and attached with stretch film to a pallet while having an improved stability.

5 It is a further objective to supply loads wrapped in stretch film with a minimum amount of stretch film material and no or minimum amount of packaging aids.

It is another objective of the invention to reduce packaging material, thereby satisfying the demand for decreasing packaging material consumption and improving ecological compatibility.

10 It is yet another objective of the invention to provide loads attached to pallets with stretchable film keeping the handling recesses of the pallet free of such film, while achieving an increased degree of stability.

An additional objective of the process of the invention is to reduce the time required to wrap a load into stretchable film and attach the load to the pallet.

15 Summary of the Invention

The present invention relates to loads made of a plurality of units assembled on a pallet, wrapped in stretchable film in a spiraling configuration to stabilize said load and at the same time attach said load to the pallet. To achieve this, the stretchable film combines folded or rolled edges, which stabilize the load 20 when spiraled around it, and has a roped lower edge when banderolling over the transition zone between load and pallet. The roped lower edge is distinguished from the folded or rolled edges by comprising more stretch film than said folded or rolled edges.

In a preferred embodiment the roped lower edge comprises 2 to 10, more preferably 5 to 10 times the amount of stretch film used for the folded or rolled part of the edges.

25 Also in a preferred embodiment the folded or rolled edges of the film are made of less than 30 mm, more preferably 10 mm to 20 mm, of stretch film width.

Yet in another preferred embodiment the package is characterized in that the roped lower edge is located around the upper part of the pallet, sufficiently high to prevent the rope of stretch film or the stretch film membrane extending towards the load from being damaged by, for example, forklifts which are usually 30 employed to lift pallets.

In general the packages can contain any common packaging aids, like for example but not limited to top- or bottom covers, layer separating sheets, corner stabilizers or soft protectors around pointy corners, although these can be eliminated in most instances.

35 Brief description of the drawings

It is believed that the present invention will be better understood by supplementing the detailed description with drawings. The accompanying drawings have designations to identify similar or identical elements in the description.

40 In the drawings :

Figure 1 is showing a broken-away, flat section of stretch film (1) having an upper edge (11) and a lower edge (12).

45 Figure 2 is showing a load (2) formed by a plurality of units (21), assembled on a pallet (3) and wrapped spirally in stretch film (1) according to known techniques, however, after only the first half of the wrapping, from top to bottom, has been done. The stretch film edges (11, 12) are flat and the attachment between the load (2) and the pallet (3) is achieved by several times horizontally wrapping the lowest banderols (123) of flat stretch film (1) over the transition from load to pallet, thereby covering the pallet recesses (31).

50 Figure 3 is showing a broken-away section of stretch film (1) with folded upper edge (111) and lower edge (121) as is used in the invention, wrapped around the load.

Figure 4 is showing a broken-away different section of stretch film (1) as used in the invention, with folded upper edge (111) and roped lower edge (115) to attach the load (2) to the pallet.

55 Figure 5 is showing a preferred embodiment of the invention, however, after only the first half of the wrapping, from top to bottom, has been done. A load (2) is wrapped with the stretch film (1) with folded edges as shown in figure 3, the attachment between load (2) and pallet (3) being achieved with the stretch film (1) as shown in figure 4.

Figure 6 is showing an alternative to the stretch film as shown in figure 3 with rolled upper edge (211) and rolled lower edge (212).

Figure 7 is showing another alternative to the stretch film as shown in figures 3 or 6 with a folded upper edge (111) and a Z fold (113) in the center of the film.

Figure 8 is showing the principle process as typically used in prior art for stretching film (1) by guiding it around a pair of rollers (41, 42) which rotate at different surface speeds with the downstream roller (42) being faster than the upstream roller (41). Other rollers guiding the film coming from an unwind section (401) or towards the load for application (402) are also shown.

Figure 9 is showing the process to create folded or rolled upper edge (111, 211) and lower edge (112, 212). Folding or rolling equipment (51, 52) is forcing the film edge (11,12) to bend into folded or rolled film edges (111, 112, 211, 212). Placement of the equipment (51, 52) upstream of the stretch rollers (41, 42) is a preferred embodiment. The roping equipment (6) is shown in a non-engaged position.

Figure 10 is showing the process to create a folded upper edge (111) and a roped lower edge (115). The roping equipment (6) is roping the stretch film (1) to such an extent that the folding or rolling equipment (52) does not reach the lower edge (12).

15 Detailed Description of the Invention and preferred Embodiments

Product Aspects of the Invention

The load (2) consists of a plurality of units (21) which themselves are often packages of several subunits. The load (2) is spirally wrapped in stretchable film (1) to protect and stabilize the contents. To accomplish this, individual bandages of stretch film (1) applied around the load (2) overlap the previous bandage, often more than by 50% of the film width, creating a unity of the overall package.

Further the load (2) is also attached to a handling and transport aid, most often a pallet (3), to enhance stability by the rigid support structure for ease of handling and transport. This is accomplished when the bandages at the bottom (123) of the load (2) are applied horizontally, extending over the load (2) and over the pallet (3).

According to one part of the invention the load (2) is spirally wrapped with a stretch film (1) with both edges folded or roped (111, 211, 112, 212) thus enhancing its stability while allowing reduction of the amount of overlap of consecutive bandages or combinations thereof. The other part of the invention is to firmly attach the stabilized load (2) to a pallet (3) by roping the lower edge (115) of the film (1) of the horizontal bandages at the bottom of the load (123). This roped lower edge (115) is distinguished from the folded or rolled lower edge (112) in that it is made of more stretch film material than the folded or rolled lower edge (112).

In a preferred version the folded or rolled film edges (111, 211, 112, 212) are formed by folding or rolling less than 30 mm, preferably 10 mm to 20 mm. This combines the advantage of improved stability and minimizes the stretch film width reduction per edge.

In another preferred embodiment the roped lower edge (115) of the stretch film (1) does not extend over the openings (31) of the pallet (3). This ensures that the stretch film (1) and the roped edge (115) are not damaged when handling or transporting the pallet (3), e.g. by using a forklift or similar equipment.

Stretch film edges (111, 211, 112, 212, 115) can be folded or rolled or be roped towards the inside or the outside of the load (2).

It is also possible to apply the stretch film (1) to the load (2) with only part of its total length folded or rolled or roped. For example the first part of the film can have flat edges (11, 12) to cover the package once with flat film and the later part can have folded or rolled and roped edges (111, 211, 112, 212, 115) in accordance with the invention or vice versa.

Another possibility to achieve the stabilizing effect to the load (2) is to fold one or several center parts of the film in a Z configuration producing a Z-fold (113). This would require a more complicated process but has the advantage of eliminating upper and/or lower folded or rolled edges (111, 211, 112, 212) of subsequent spiralling banderols to overlap and thereby exert especially high partial pressure onto the load (2). It is particularly advantageous to have an upper folded or rolled edge (111, 211) and one center Z-fold (113).

Advantages of stability or reduced material consumption or combinations thereof are independent of the particular load (2) or the particular way of assembling it. Hard or soft or even squeezable units (21) forming the load (2) orderly stapled or randomly piled on a pallet can benefit from the invention.

Also loads (2) requiring breathability can be packed using the invention. For example spiralling steep enough to eliminate overlap, or folding and rolling enough of the stretch film width, to prevent overlapping of successive bandages of stretch film (1) can be used to allow breathability.

Selection of a particular film material is also not crucial to the invention. The invention can essentially

be produced with any available stretch film materials usually employed. Film materials having a single sided self adherence are preferred since they will help stabilize the folded or rolled and the roped edges.

Process and Equipment Aspects of the Invention

5

To make loads (2) as described above the following process steps are required : Unwinding of the stretch film (1), stretching of it and application to the load. As indicated in the prior art many processes and machines accomplish the above. Typically the process involves an unwind stand from which the film is drawn around a non-driven guiding roll (401) to a first driven stretch roll (41) which rotates at a lower surface speed than the second driven stretch roll (42). The difference in speed produces the stretching of the film (1) which is guided for example by another non-driven guiding roll (402) and applied to the palletized load (2) by relative rotation of the palletized load and the stretchable film (1). According to the invention this standard process is complemented by folding or rolling and by roping of the film edges (111, 211, 112, 212, 115) to yield the stretched stretch film (1) for the invention. Placing standard equipment parts like a roller or a folding board or a folding bar (51, 52, 6) as an obstacle into the path of the film edge (11, 12) gradually bends the film edge (11, 12) thus producing the desired result (111, 211, 112, 212, 115). The depth and angle at which these standard equipment parts (51, 52, 6) are placed into the path of the film edge (11, 12) is decisive whether folding or rolling or roping occurs. Hence the desired film edge configuration can easily be defined taking characteristics of load (2), film (1) and handling needs into account.

To achieve folding or rolling of the film edges (111, 211, 112, 212) when wrapping the load (2) and a roped lower film edge (115) when attaching the load (2) to the pallet (3), a controller engages the roping equipment only during the time when the bandages at the bottom (123) are produced. The controller is not shown in the figures but can be, for example, a mechanical, electrical or magnetic sensor combined with a suitable activator to move the roping equipment. A preferred execution is to use a purely mechanical sensor/activator combination.

As will become more apparent from the example, application of this process and equipment will lead to the additional advantage of reduced time required to wrap a load (2) into stretch film (1) due to the reduced number of bandages around the load (2) and the reduced overlap between successive bandages.

For the process it is not essential where along the path of the film the folding or rolling and the roping process are placed. However it has been found to be most advantageous to have the folding or rolling devices (51, 52) upstream of the stretch rollers (41, 42) and the roping device (6) installed downstream of the stretch rollers (41, 42).

The process can be further supplemented by nip-rolls pressing the formed edge, folded or rolled or roped, (111, 211, 112, 212, 115) tightly together. Nip-rolls are not shown in the figures. They may be particularly advantageous where stretch film (1) of little or no adhesiveness is used.

In a preferred process and equipment embodiment according to the invention, the combination of the lower edge folding or rolling step with the roping step is achieved by using, relative to the stretch film (1), movable equipment or equipment mounting.

But also for example for loads (2) requiring breathability it may be advantageous to install adjustable or movable rolling or folding (51, 52) equipment.

Example

Hereafter particular examples are described showing in detail the application of the invention.

As a basis a standard CEKA Dominant satellite stretch wrapper is used. Loads consisting of soft polybag loads are assembled on a pallet. The conventional corner cardboard parts which used to be necessary to complete the loads such that they have acceptable stability are omitted. On the satellite, two bars are installed perpendicular to the plane of the stretch film with a slight angle in the flow direction of the film. The bars are installed on brackets upstream of the stretch rollers. The bars create obstacles reaching 15 mm into the path of the stretch film measured from the stretch film edges. The bars bend the self adhesive side of the film edges towards the self adhesive side of the film and the fold thus formed is pressed together when the film is stretched around the stretch rollers. Nip rolls are not necessary since the self adhesiveness is sufficient to overcome the internal material resilience.

Behind the stretch rolls a roping roll of hourglass shape is installed on a bracket which is movable by a lifting magnet. The magnet is controlled by an electro magnetic switch turning on when the horizontal banderols are produced attaching the load to the pallet. Alternatively the hourglass shaped roll can be installed on a bracket which fixes it at the desired height by being mechanically limited to move further

down when the horizontal banderols are being produced. The hourglass shaped roping roll when engaged extends 150 mm into the film width. The axis of the roping roll is approximately perpendicular to the plane of the film.

In the engaged position the roping roll is at level with the upper part of the pallet but not on or below the level of the handling openings in the pallet.

The following table shows variables and especially the improvements achieved by executions according to the invention in comparison to equivalent executions according to known techniques. For both examples the stretch film material is polyethylene and the application equipment is a CEKA Dominant satellite stretch wrap machine.

Stability in these examples was graded by putting the products on a 24° slope and measure the bending of a 2 m high load versus a line perpendicular to the pallet. Grade positive was given for less than 5 cm bending and grade negative was given for more than 10 cm bending. Loads tipping over were excluded, but noted.

	<u>execution according to the invention</u>	<u>execution generally according to the invention but without folding, rolling or roping steps</u>
1. Load	Cardboard boxes	Cardboard boxes
stretch film thickness	0.019 mm	0.023 mm
elongation of the film	172%	102%
width of film	500 mm	500 mm
width of film used per folded edge	15 mm	no folded edges
width of film used per roped edge	120 mm	no roped film edge
number of film banderols	9	12
index of film used for total wrapping	46%	100%

	<u>execution according to the invention</u>	<u>execution generally according to the invention but without folding, rolling or roping steps</u>
5		
10	total time to wrap one pallet	1 min, 33 sec
		1 min, 50 sec
15	index of efficiency	118%
		100%
	openings in pallet	not covered
		covered and punched
20	stability grade after 2 hours	positive (also after 2 days)
		negative
25		
30	<u>execution according to the invention</u>	<u>execution generally according to the invention but without folding, rolling or roping steps</u>
35		
	2. Load	Soft poly bags
40		Soft poly bags
	stretch film	
	thickness	0.019 mm
		0.023 mm
45	elongation of film	172%
		102%
50		
55		

	<u>execution according to the invention</u>	<u>execution generally according to the invention but without folding, rolling or roping steps</u>	
5			
10			
	width of film	750 mm	500 mm
15	width of film used per folded edge	15 mm	no folded edges
20	width of film used per roped edge	120 mm	no roped edge
25	number of film banderols	14	21
	index film used for total wrapping	61%	100%
30	openings in pallet	not covered	covered and punched
35	packaging aids	not necessary	4 cardboard corners
	stability grade after 2 hours	positive (also after 2 days)	negative, some times tips over

Although many preferred and optional embodiments have been described in detail and illustrated by the drawings and the examples, many variations are possible which still fall within the scope of the claimed invention.

Claims

1. A load (2) formed by a plurality of units (21), assembled on a pallet (3) and spirally wrapped with a stretchable film (1) characterized in that
both edges (111, 211, 112, 212) of said film (1) are folded or rolled where said film (1) wraps around said load (2) and that
the lower edge (115) of said film (1) forming the bandages at the bottom (123) of the load (2) is roped, said roped lower edge (115) being formed by more film (1) than said folded or rolled lower edge (112, 212)
2. A palletized load (2) according claim 1 characterized in that the folded or rolled edges (111, 211, 112, 212) of said film (1) are formed by folding or rolling at least 30 mm, preferably 10 to 20 mm of the width of said film (1).

3. A palletized load (2) according to any of the preceding claims characterized in that said roped lower edge (115) of said film (1) comprises an amount of film of 2 to 10 times, preferably 5 to 10 times the amount of said folded or rolled lower film edge (112, 212).
- 5 4. A palletized load (2) according to any of the preceding claims characterized in that said roped lower film edge (115) leaves the openings (31) in said pallet (3) uncovered.
5. A palletized load (2) according to any of the preceding claims characterized in that only part of the total length of said film edges (11,12) are folded or rolled or roped.
- 10 6. A palletized load (2) according to any of the preceding claims characterized in that only one film edge is folded or rolled (111, 211, 112, 212) and at least one Z fold (113) is provided in the center portion of the film (1).
- 15 7. A process suitable to make palletized loads (2) according to any of the preceding claims comprising
 - unwinding and stretching of said stretchable film (1) and
 - application of said film (1) to a palletized load (2) in a spiraling configuration by rotating said palletized load (2) relative to said film unwinding and stretching and simultaneously
 - moving said film vertically up and downcharacterized in that
20 along the path of said film (1), preferably prior to said stretching process, the edges of said film (111, 211, 112, 212) are being folded or rolled and the lower edge (115) of said film is roped when bandages are applied around the bottom (123) of said load (2) and around the top of the pallet (3).
- 25 8. A process according to claim 7 characterized in that said folded or rolled film edges (111, 211, 112, 212) or the roped film edge (115) are stabilized in an additional step by pressing the folds or rolls or the rope together.
- 30 9. An apparatus to carry out the process according to claim 7 comprising a load stand, a film unwind unit, a film stretch unit, a drive to rotate said load stand or a drive to rotate said unwind and said stretch unit around said load (2) characterized in that in addition it comprises
 - guiding means (51, 52) to fold or roll the edges (111, 211, 112, 212) of said film (1) and
 - guiding means (6) to rope the lower edge (115) of said film (1) operated by a controller such that35 said roped edge (115) is wrapped around said pallet (3) only.
10. A machine according to claim 9 characterized in that said guiding means (51, 52) for folding or rolling or said guiding means (6) for roping are folding bars, rollers or folding boards.
- 40 11. A machine according to claim 9 or 10 characterized in that said controller is a mechanical stop.
12. A machine according to claim 9, 10 or 11 characterized in that said guiding means forming the folded or rolled edges (111, 211, 112, 212) are mounted on brackets allowing to engage or disengage said guiding means (51, 52, 6).
- 45 13. A machine according to claims 9, 10, 11, or 12 characterized in that nip-rolls are mounted subsequent to said guiding means (51, 52, 6) forming the folded or rolled edges (111, 112).

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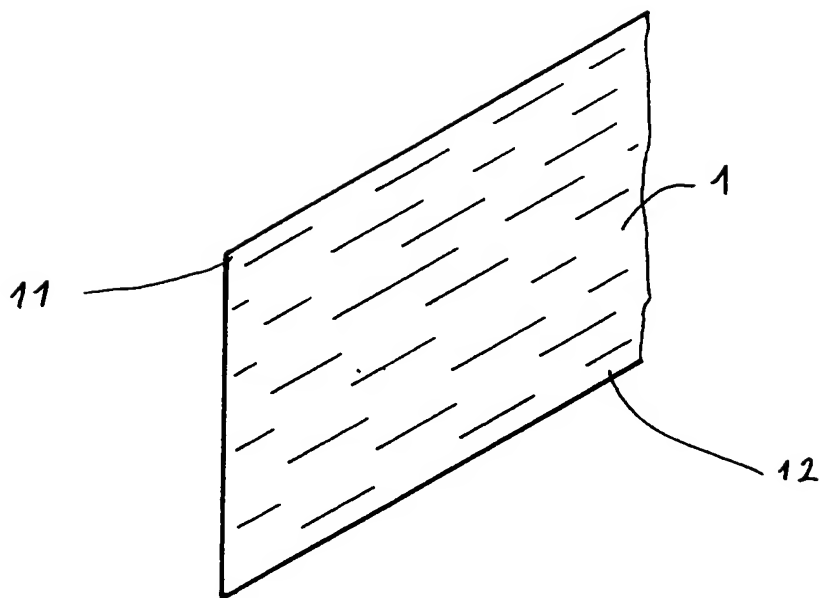


Figure 1

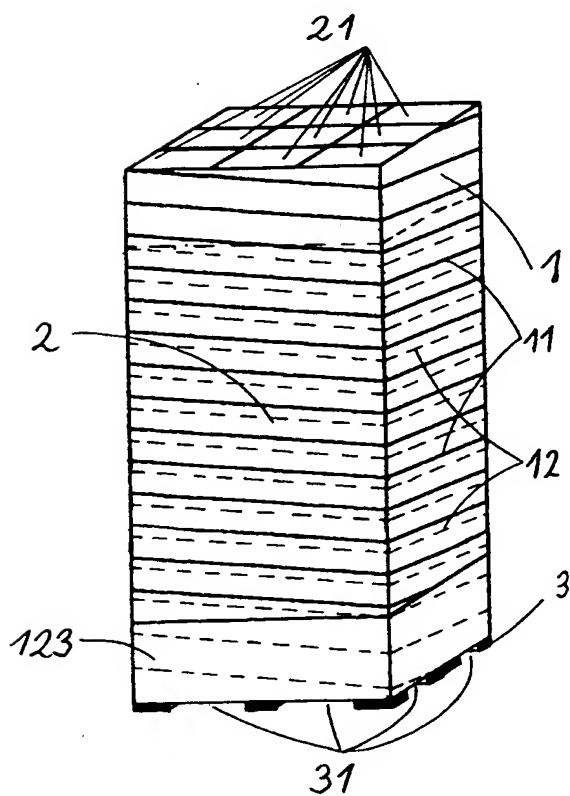


Figure 2

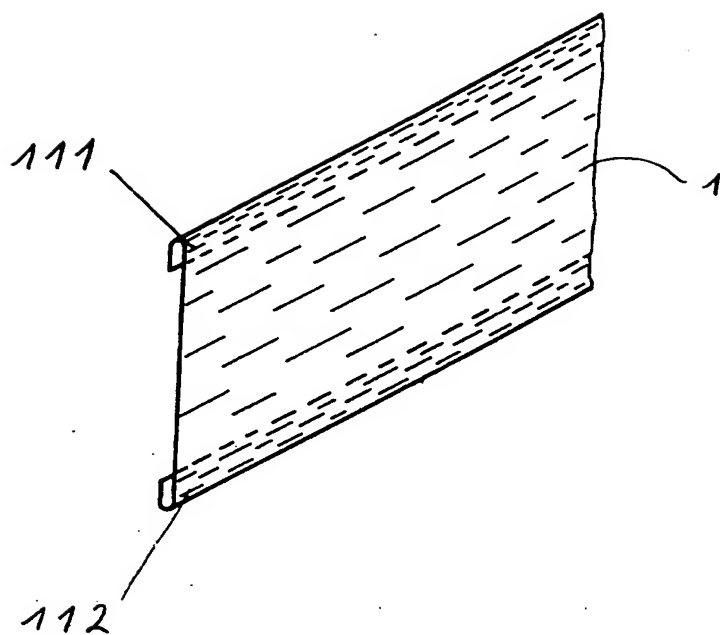


Figure 3

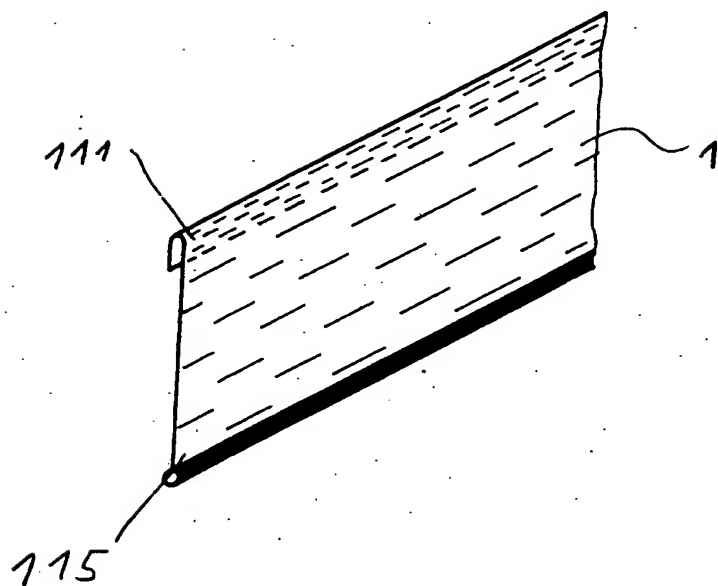


Figure 4

Figure 5

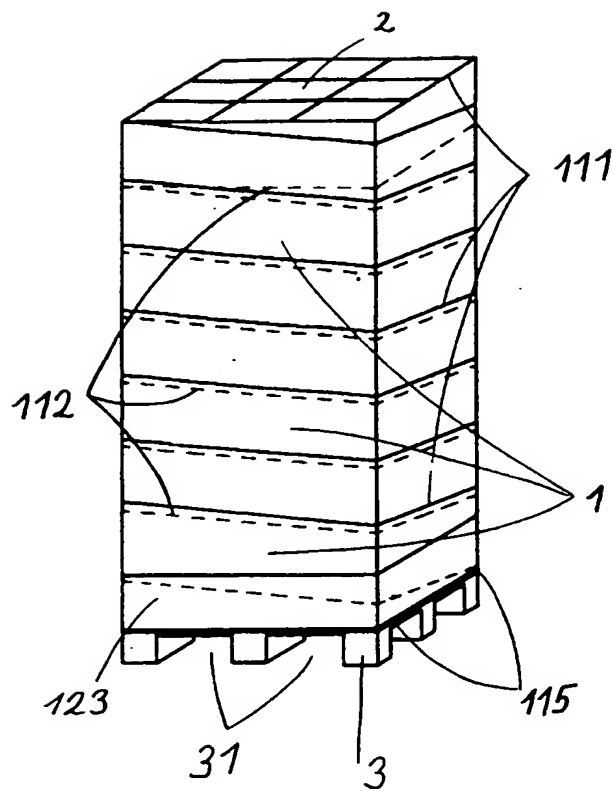
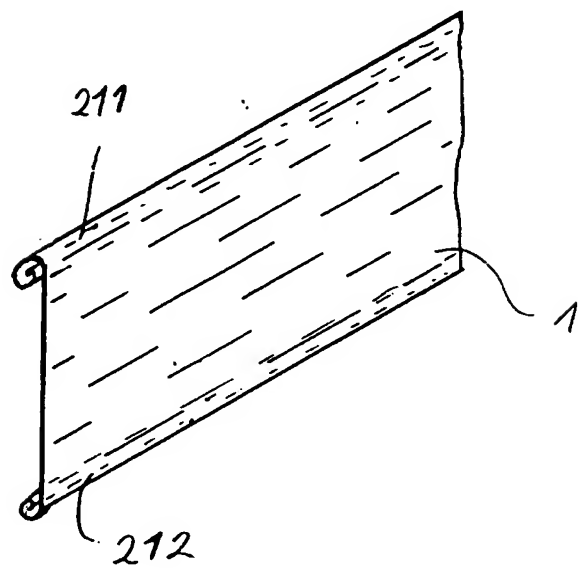


Figure 6



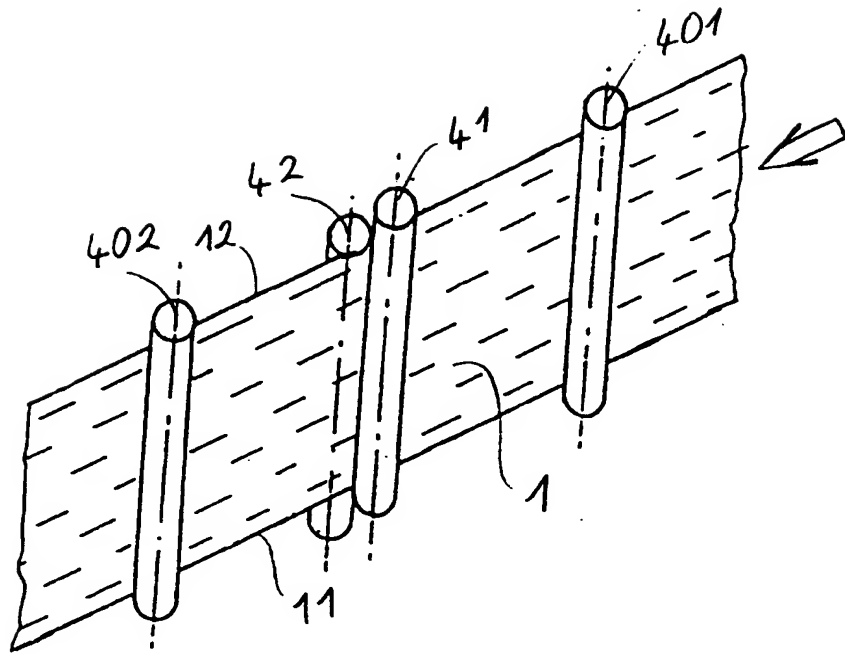


Figure 8

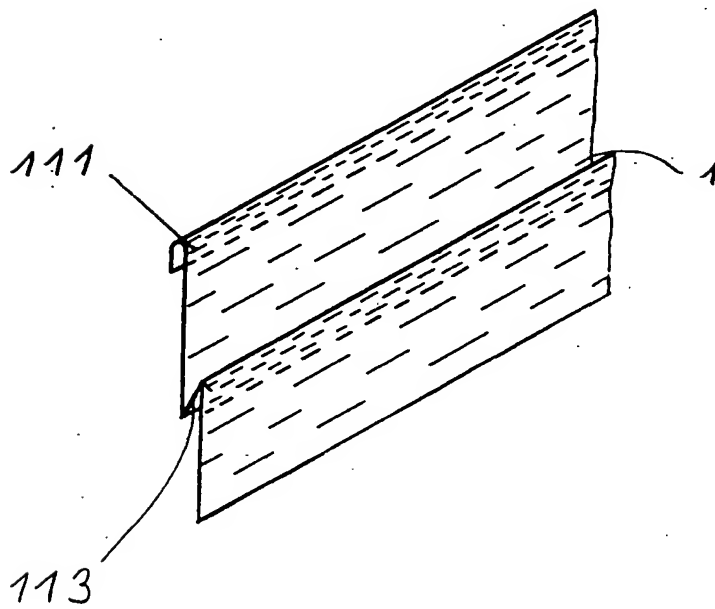


Figure 7

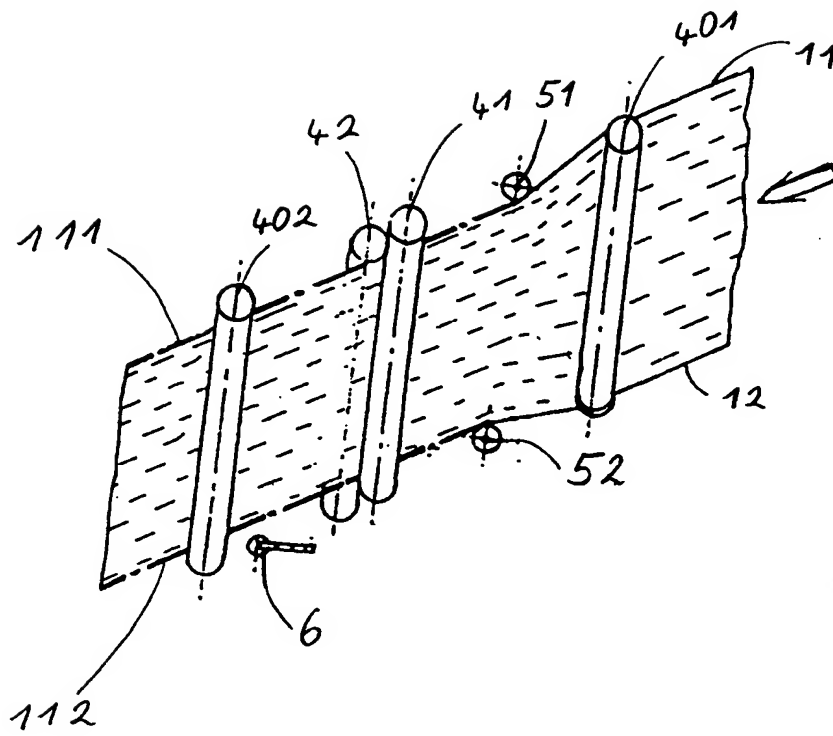


Figure 9

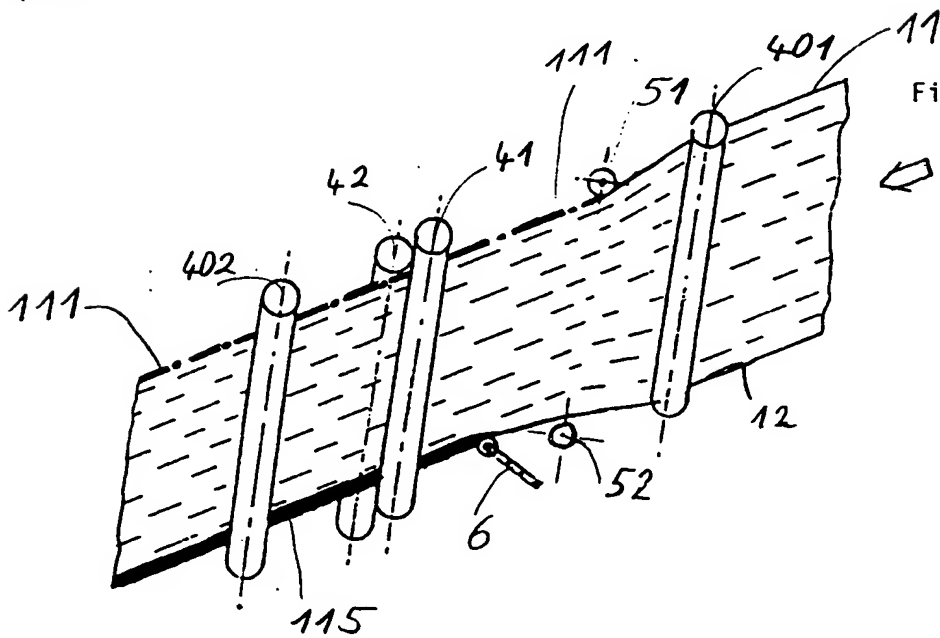


Figure 10



European
Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 20 1933

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 300 855 (NEWTEC) * Column 17, line 25 - column 18, line 26; figures 18-20 * - - -	1,6,7,9,10	B 65 B 11/04 B 65 B 11/02
A,D	US-A-4 807 427 (CASTEEL) * Column 3, lines 4-27; figures 1,2 * - - - - -	1,3,7,9, 10,12	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 65 B
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		12 February 91	CLAEYS H.C.M.
<div><div>CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention</div><div>E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons ----- &: member of the same patent family, corresponding document</div></div>			